Admin Record

MEMORANDUM

SUBJECT: Estuarine Habitat Criteria for Bay/Delta - Discussion of Revisions to Proposed Rule

FROM: Bruce Herbold

TO: Patrick Wright

DATE: August 31, 1994

This memorandum summarizes the changes we are considering for the Estuarine Habitat criteria in the Bay/Delta, and presents a restatement of those criteria based on these changes.

a. Proposed Rule

The Proposed Rule included salinity criteria to protect the Estuarine Habitat and other designated fish and wildlife uses in the estuary. The criteria specified the location and number of days of required compliance. EPA's specific proposed criteria are shown in Table [1]. They included 2 ppt salinity criteria[1] at Roe Island, Chipps Island, and at the Sacramento/San Joaquin River confluence from February through June. The criteria replicated the average number of days on which the 2 ppt isohaline occurred at or downstream from each of these locations during the historical period 1940-1975, inclusive, classified by water year type. Because no critically dry years occurred in the period from 1940 to 1975, the required number of days for critically dry years was based on an extrapolation of the data.

The proposed criteria were to be measured using a 14-day moving average. The use of a 14-day moving average allowed the mean location to be achieved despite the varying strength of tidal currents during the lunar cycle because any 14 day period would include the full range of spring and neap tidal conditions.

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[1] EPA's Estuarine Habitat criteria are stated as a certain number of days when the near-bottom salinity at each of three locations in the estuary is less than 2 parts per thousand. This salinity is approximately equivalent to electrical conductivity less than 2694 mmhos when corrected to a temperature of 25.

Table 1. Proposed 2 ppt Salinity Criteria*

Year type	Roe Island [km 64]	Chipps Island [km 74]	Confluence [km 81]
wet	133 days	148 days	150 days
above normal	105 days	144 days	150 days
below normal	78 days	119 days	150 days
dry	33 days	116 days	150 days
critically dry	0 days	90 days	150 days

*Numbers indicate required number of days (based on a 14-day moving average) at or downstream from each location for the 5-month period from February through June. The water year classifications are identical to those included in the 1991 Bay/Delta Plan for the Sacramento River Basin. Roe Island salinity shall be measured at the salinity measuring station maintained by the USBR at Port Chicago (km 64). Chipps Island salinity shall be measured at the Mallard Slough station, and salinity at the Confluence shall be measured at the Collinsville station, both of which are maintained by the California Department of Water Resources. The Roe Island number represents the maximum number of days, based on the adjustment described below.

The Proposed Rule also included a "trigger" that limited the applicability of the Roe Island criteria. Under the Proposed Rule, the criteria of number of days for a given year type at Roe Island would not apply unless and until the average daily salinity at Roe Island attained the 2 ppt level through natural uncontrolled flows. Following the occurrence of such an event, the 14 day average salinity at Roe Island could not exceed 2 ppt for the number of days specified in Table [1]. Therefore, the number of days listed under Roe Island represented the maximum of the number of days that could be required. In effect, this adjustment provided that the additional water needed to move the isohaline downstream to Roe Island would come from natural storms rather than from reservoir releases or export restrictions. This approach better reflected the natural variability in timing and quantity of runoff and significantly reduced the water supply impacts of the proposed criteria relative to criteria that do not account for this variability.

In the Proposed Rule, EPA specifically requested public comment on a number of issues associated with the proposed Estuarine Habitat criteria, including the desirability of stating

the criteria as a "sliding scale" rather than by water year categories, the appropriate compliance measurement period, and the appropriate reference period for criteria target levels. EPA has incorporated many of the comments received on these and other issues in its revisions to the Proposed Rule.

b. Specific changes to the Estuarine Habitat criteria

(1) Sliding scale. The Proposed Rule outlined the rationale for moving from criteria varying by the five water year types to criteria stated as a sliding scale or a smooth function varying with changes in unimpaired flow. The comments EPA received on the Proposed Rule were generally supportive of this change in approach. (California Urban Water Agencies (CUWA) 1994, California Department of Water Resources (California DWR) 1994, Natural Heritage Institute (NHI) 1994, and Kimmerer 1994) Both written comments and the discussions at the CUWA scientific workshops offered several suggestions as to how the sliding scale function should be formulated.

EPA has concluded that the Estuarine Habitat criteria should be stated as a logistic equation defining the sliding scale. Dr. Wim Kimmerer, in his comments on the Proposed Rule (Kimmerer 1994), noted that the logistic model is "appropriate for a relationship between a dichotomous variable (i.e. compliance or no compliance) and a continuous variable." A logistic model cannot require fewer than 0 or more than the number of days available in the month, whereas linear equations (such as one included in written comments of Contra Costa Water District (CCWD)(CCWD 1994) or quadratic equations (such as the one EPA suggested in the Proposed Rule) can result in unrealistic extrapolations. Kimmerer suggested a sliding scale that set the percentage of the 5 month period that would be required at each control point as a function of the five months of unimpaired flow data and the desired level of protection. An example of these equations for Roe Island is shown in Figure [1]. As discussed below, however, EPA has revised the logistic equations to reflect monthly computations of compliance.

(2) Reference period/level of development. EPA received substantial comment about its choice of an historical reference period to define the targeted level of protection for the Estuarine Habitat criteria. One group of comments criticized the choice of the years included in the reference period. Various other historical periods were discussed by different commenters as alternatives. (Bay Institute 1994, California DWR 1994, and NHI 1994). A second set of comments raised a more fundamental problem with the use of an historical reference period. These comments argued that the choice of a particular historical reference period was inherently suspect, because this approach necessarily reflected, but could not distinguish between, hydrological conditions in the reference period and the

"level of development" (the existing water diversion and storage facilities) in the reference period. (California DWR 1994).

This issue was discussed in depth at the CUWA scientific workshops, and EPA believes that a reformulation of the "reference period" is appropriate. In the final rule, EPA is establishing Estuarine Habitat criteria that replicate the "level of development" existing in 1968. The use of individual calendar years appears to be a reasonable surrogate for the level of development, at least up to the time of the late 1970's when new water facility development declined and regulation by the State Water Resources Control Board began to control the operations of water projects.

The intent of these criteria is to protect the Estuarine Habitat and related fish and wildlife designated uses to the same degree that these uses would have been protected under the level of development present in 1968. To calculate these criteria, EPA and others developed regression equations that explained the variability in the location of the 2 ppt isohaline as a function of two variables: calendar year as a surrogate for the level of development and unimpaired flow as a measure of precipitation. (Kimmerer 1994). This procedure allows EPA to separate the effects of year to year variability in precipitation from the effects of increased levels of upstream storage and diversion. At a given level of development, then, the regression equations can predict the position of the 2 ppt isohaline from a given pattern of precipitation.

This process of developing a sliding scale is shown graphically in Figure [2]. The response surface or curved plane generated in Figure [2] shows how the number of days of 2 ppt salinity reflects the changing level of development over different hydrological conditions. A single sliding scale equation can be derived by taking a "slice" of the curved plane at the 1968 level of development. This 1968 curve shows how the number of 2 ppt days would have varied during different hydrological conditions at the 1968 level of development. Historically, of course, 1968 experienced only one hydrological scenario; the purpose of the regression equation for the 1968 level of development is to show how that particular level of development would have influenced the position of the 2 ppt isohaline over the entire range of possible hydrological conditions.

EPA chose the 1968 level of development because of a widespread perception that at that time there was adequate estuarine habitat to sustain most aquatic populations in the Bay/Delta. As explained in the Proposed Rule, EPA and the Federal fisheries agencies have frequently called for a level of protection equal to that which existed in the late 1960's and early 1970's. EPA believes that the fish population data summarized in the San

Francisco Estuary Project's Status and Trends Report document the precipitous and unreversed decline of the most abundant species beginning in 1970. (Herbold et al. 1992). This downward trend is also apparent in the population data for winter run Chinook salmon. (Herbold et al. 1992).

(3) Use of entire basin unimpaired flow. The Proposed Rule stated flow as measured by the Sacramento Basin Water Year Type classification. This was done primarily to simplify calculations and to reflect the dominant role of Sacramento River flows in the Bay/Delta estuary. Nevertheless, in some circumstances, the omission of the San Joaquin River basin flows could significantly over or understate the actual hydrological conditions in the estuary. Further, one of the reasons EPA chose the three locations for compliance (all at or downstream of the confluence of the Sacramento and San Joaquin Rivers) was to give the State Board maximum flexibility in determining the source of flows to meet the Estuarine Habitat criteria. To reflect the importance of the San Joaquin river basin, the final criteria are stated in reference to unimpaired flow of both the Sacramento River basin (Sacramento, Feather, Yuba, and American rivers) and the San Joaquin River basin (Stanislaus, Tuolumne, Merced and San Joaquin rivers). EPA believes that the Sacramento/San Joaquin Unimpaired Flow Index described by CUWA is the best statement of how this unimpaired flow should be computed.[2]

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[2]As stated on page 3 of Appendix 1 to the California Urban Water Agencies "Recommendations to the State Water Resources Control Board for a Coordinated Estuarine Protection Program for the San Francisco Bay-Sacramento and San Joaquin River Delta Estuary" dated August 25, 1994, the Sacramento/San Joaquin Unimpaired Flow Index "shall be computed as the sum of flows at the following stations:

1. Sacramento River at Band Bridge, near Red Bluff
2. Feather River, total inflow to Oroville Reservoir
3. Yuba River at Smartville
4. American River, total inflow to Folsom Reservoir
5. Stanislaus River, total inflow to New Melones Reservoir
6. Tuolumne River, total inflow to Don Pedro Reservoir
7. Merced River, total inflow to Exchequer Reservoir
8. San Joaquin River, total inflow to Millerton Lake."

(4) Modeling salinity and flows. The Proposed Rule relied on certain correlations to describe the relationship between biological responses and salinity. In developing these correlations, the Proposed Rule used a model of the relationship between salinity and flow to estimate salinity conditions in those limited instances when salinity data were unavailable. EPA also used this model to estimate salinity conditions for earlier historical periods when flows were measured but salinity was not. This model, which was used by the San Francisco Estuary Project (SFEP 1993), was considered at that time to be the most accurate available for this purpose. Since the Proposed Rule was published, a new model correlating salinity and flow has been developed by CCWD. (Denton, R.A. 1993, and Denton, R.A. 1994.) The participants at the CUWA scientific workshops generally agreed the CCWD model is a more appropriate model to use in developing the Estuarine Habitat criteria, and EPA agrees. The final rule will use this new CCWD model to estimate the number of days that salinities have been less than 2 ppt historically at each of the compliance monitoring stations.

(5) Previous month flow index. The Proposed Rule stated that the target number of days of compliance at Chipps and Roe Island would vary according to the Sacramento Basin Water Year Type. EPA has received comments (California DWR 1994) and participated in discussions at the CUWA scientific workshops raising concerns over the use of the standard water year classifications as the measure of hydrological conditions in the estuary. In essence, these comments suggested that the requirements to protect estuarine habitat ought to be stated solely, or largely, in reference to the patterns of precipitation that could directly affect estuarine habitat during the period intended for protection. For example, criteria that are designed to protect conditions in the February-June period should reference only the unimpaired flows of February-June (or, possibly, January-June). Including precipitation in other months or the amount of carryover storage in reservoirs from previous years (both of which are included in the Sacramento Basin Water Year Type calculation) could lead to inaccuracies in the criteria that could unnecessarily affect water project operations or inadequately protect the designated uses.

A related issue created by the Proposed Rule is the need to develop compliance strategies for a given year based on a forecast of hydrological conditions expected during the following months. This forecasting is notoriously inaccurate, especially for the critical February and March months which are typically the months of most variable precipitation. Sliding scales such as Figure [1] (for Roe Island), which apply to the entire February to June period of protection, still require the project operators to forecast future hydrological conditions to meet the expected number of required days of compliance with the 2 ppt criteria. As such, the modeling approach suggested by Kimmerer

and shown for Roe Island in Figure [1] would not address the issue of unreliable forecasts.

Analysis by EPA staff indicated that the required number of days of compliance with the 2 ppt criteria in a given month could be quite accurately predicted from logistic models using unimpaired flows of the current month, the previous month, the previous two months or the previous and current month. Inclusion of the actual unimpaired flows of the current month did not reliably improve model performance and, of course, the actual unimpaired flow of the current month cannot be known accurately until the month is over. EPA has, therefore, recast the criteria using the model suggested by Kimmerer, but only for one month at a time based on the preceding month's unimpaired flow. For example, the measured unimpaired flow in January would be used to set the number of days of compliance with the 2 ppt criteria at the Chipps and Roe island locations. Similarly, measured unimpaired flow in February is used to set the next month's requirement. This approach has been labeled the "Previous Month's Index" (PMI) approach. To make this approach work, the sliding scales exemplified (for Roe Island) in Figure [1] have been transformed into monthly sliding scales. These monthly logistic equations for both Chipps and Roe islands are shown graphically in Figure [3].

One additional refinement should be considered when the implementation plan is developed for these criteria. The river flow data used in the monthly calculation of the PMI are generally not available until the 10th day of the following month. To assist in the timing of compliance, it may be appropriate to allow the period for meeting the required number of 2 ppt days to extend forward 10 days into the subsequent month. For example, if the PMI computation at the end of January indicates that 28 days of compliance with the 2 ppt criteria are required at Chipps Island in February, this number could be satisfied on any of the days between February 10 and March 10. Any such implementation flexibility would have to assure that days of compliance are not "double counted", and that the critical period of early February is still protected. However, it would be appropriate for the implementation plan to flexibly address this issue.

(6) Revised "trigger" for Roe Island criteria. As a result of the above changes to the Estuarine Habitat criteria, the "trigger" for the Roe Island location must be revised. The Proposed Rule stated, in effect, that if the salinity dropped below 2 ppt at Roe Island due to uncontrolled hydrologic conditions, the Roe Island requirements were "triggered" for the remainder of the February to June compliance period. In the final rule, the "trigger" is evaluated on a monthly basis. If the 14-day average salinity at Roe Island falls below 2 ppt on any day during the last 14 days of a month, compliance with the

Roe Island criteria would be "triggered" for the following month. For example, assume that the PMI for January indicates 18 days of compliance in February, and that the 14-day average salinity in the last part of January is below 2 ppt at Roe Island. This would trigger the applicability of the Roe Island criteria in February. Assume then that the system is operated to meet the 18 days in February, but that a large storm in mid-February results in the salinities of less than 2 ppt at Roe Island for the entire month of February. This would "trigger" Roe Island criteria in March. If the PMI-based calculation required 31 days of compliance at Roe Island in this scenario, compliance for April (for 13 days, for example) would also be triggered. If April is a dry month, the 2 ppt criteria could be met for the required 13 days early in the month, and the Roe Island criteria would not be triggered for May at all.

Although somewhat complicated, this monthly triggering mechanism is essential to assure that the criteria applicable to a given month reflect the actual distribution of storm events throughout the compliance period. As explained in more detail in the preamble to the Proposed Rule, accounting for the natural hydrologic cycles assures protection of the designated uses without unnecessarily affected water project operations.

(7) Measuring compliance. Implementation measures for these Estuarine Habitat criteria will be developed by the State Board. In the Proposed Rule, EPA indicated that it believed an implementation plan that relied on the salinity-flow models, without making additional allowances for "confidence intervals", would adequately protect the designated uses. EPA's further review of the comments and continued discussions with the project operators has confirmed this belief. This would allow project operators to meet the criteria by providing the modeled "flow equivalent" of a particular salinity target. In addition, EPA believes that the designated fish and wildlife uses would be protected if the Estuarine Habitat criteria are directly measured as either a daily salinity value or as a 14-day average salinity value. This means that the State Board could adopt an implementation providing that project operators would be in compliance with the criteria in any one of three ways: (1) the daily salinity value meets the requirement, (2) the 14-day average salinity meets the requirement, or (3) the system is operated on that day so as to meet the "flow equivalent," using the model, of the stated salinity requirement. EPA notes that under most circumstances, the most efficient approach (in terms of water usage) to meeting the criteria would be to satisfy the specified salinity value rather than the alternative flow equivalent.

c. Revised Estuarine Habitat Criteria

In order to reflect the changes listed above, the Estuarine Habitat criteria have been revised. The revised Estuarine Habitat criteria provide that salinity shall not exceed 2 ppt (measured on a 14-day moving average) at Roe Island (if triggered) and Chipps Island for the number of days each month in the February to June period computed by reference to the following formula.

$$\text{\# of days required in Month X} = \text{Total \# of days in Month X} * (1-1/(1+e^{K}))$$

where
K = A + (B*natural logarithm of the previous month's 8-river index)
and A and B are determined by reference to Table [2] for the Roe Island and Chipps Island locations.

Month X	Chipps Island		Roe Island (if triggered)	
	A	B	A	B
Feb	-*	-*	-14.36	+2.068
Mar	-105.16	+15.943	-20.79	+2.741
Apr	-47.17	+6.441	-28.73	+3.783
May	-94.93	+13.662	-54.22	+6.571
June	-81.00	+9.961	-**	-**

Table 2. Constants appropriate to each of the monthly equations to determine monthly requirements described. *Coefficients for A and B are not provided at Chipps Island for February, because the 2 ppt criteria must be maintained at Chipps Island throughout February under all historical PMI values for January. **Coefficients for A and B are not provided at Roe Island for June, because under the equations used the 2 ppt criteria will never be required at Roe Island in June, regardless of the PMI value for May. This is true even if the Roe Island criteria are triggered earlier in the spring.

Examples of the required number of compliance days resulting from the computation of these equations across a range of previous monthly 8-river index (PMI) values are presented in Table [3].

The criteria at Roe Island shall be required for any given month only if the 14-day average salinity at Roe Island falls below 2 ppt on any of the last 14 days of the previous month.

As in the Proposed Rule, the final rule provides that salinity at the Confluence of the Sacramento and San Joaquin Rivers (Collinsville Continuous Monitoring Station C-2) shall not exceed 2 ppt throughout the period February 1 through June 30.

PMI	Chipps Island					Roe Island (if triggered)			
	Feb	Mar	Apr	May	Jun	Feb	Mar	Apr	May
250	0	0	0	0	0	1	0	0	0
500	28	0	0	0	0	5	1	0	0
750		18	0	0	0	9	2	1	0
1000		31	2	0	0	13	4	2	0
1250			7	0	0	17	7	4	0
1500			15	0	0	19	10	8	0
1750			21	0	0	21	13	11	0
2000			26	1	0	22	16	15	0
2500			29	16	1	24	20	21	2
3000			29	29	7	25	24	25	5
4000			30	31	25	26	27	28	18
5000					29	27	29	29	26
6000					30	28	30	30	29

Table 3. Examples of required number of days of compliance for each month across a range of possible values of the 8-river index for the prior month (PMI).

REFERENCES

Bay Institute 1994. Comments on the proposed Rule for Water Quality Standards in the Bay/Delta, 1 p., plus three appendices and three enclosures.

California Department of Water Resources 1994. Comments on the Water Quality Standards for the Bay and Delta, 2 pp., plus 88+ pp. comment booklet and 7 appendices.

California Urban Water Agencies 1994. Comments on the Water Quality Standards for the Bay and Delta, 3 pp., plus 5 pp. supplementary comments and 12 draft technical appendices.

Contra Costa Water District 1994. Comments on the Water Quality Standards for the Bay and Delta, 5 pp., plus 2 attachments.

Denton, R.A. 1993. Accounting for Antecedent Conditions in Seawater Intrusion Modeling - Applications for the San Francisco Bay/Delta Hydraulic Engineering 93, vol 1, pp 448-453.

Denton, R.A. 1994. Minor Modifications to the G-Model Fit of Electrical Conductivity Versus Antecedent Outflow. Internal CCWD report, 8 pp.

Herbold, B., A.D. Jassby, P.B. Moyle, 1992. San Francisco Estuary Project Status and Trends Report on Aquatic Resources in the San Francisco Estuary. March 1992. 257 pp.

Kimmerer, W. 1994. A sliding scale for the EPA salinity standard. 12 p.

Natural Heritage Institute, 1994. Comments on the proposed rule for water quality standards in the Bay/Delta, 1 p., plus 42+ pp. of comments and Attachments A-F.

SFEP, 1993. Managing Freshwater Discharge to the San Francisco Bay/Sacramento-San Joaquin Delta Estuary: The Scientific Basis for an Estuarine Standard. 17 pp. + appendices.

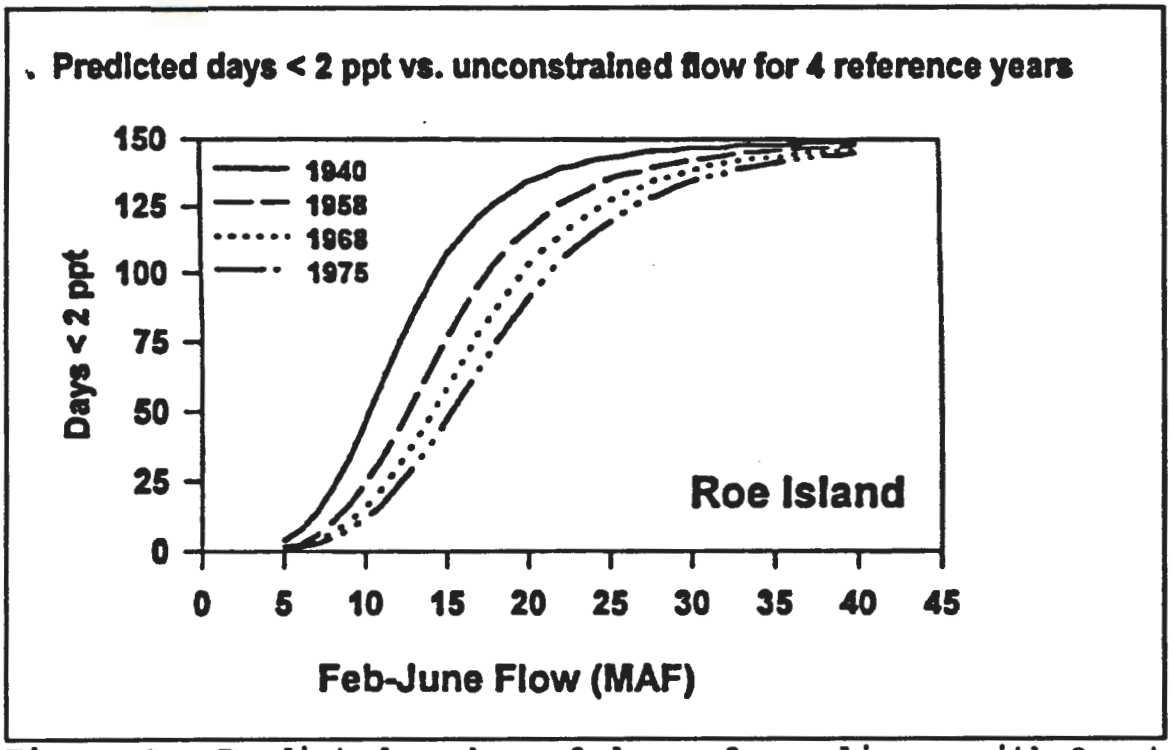

Figure 1. Predicted number of days of compliance with 2 ppt criteria during February to June at four levels of development across a range of unimpaired flows.

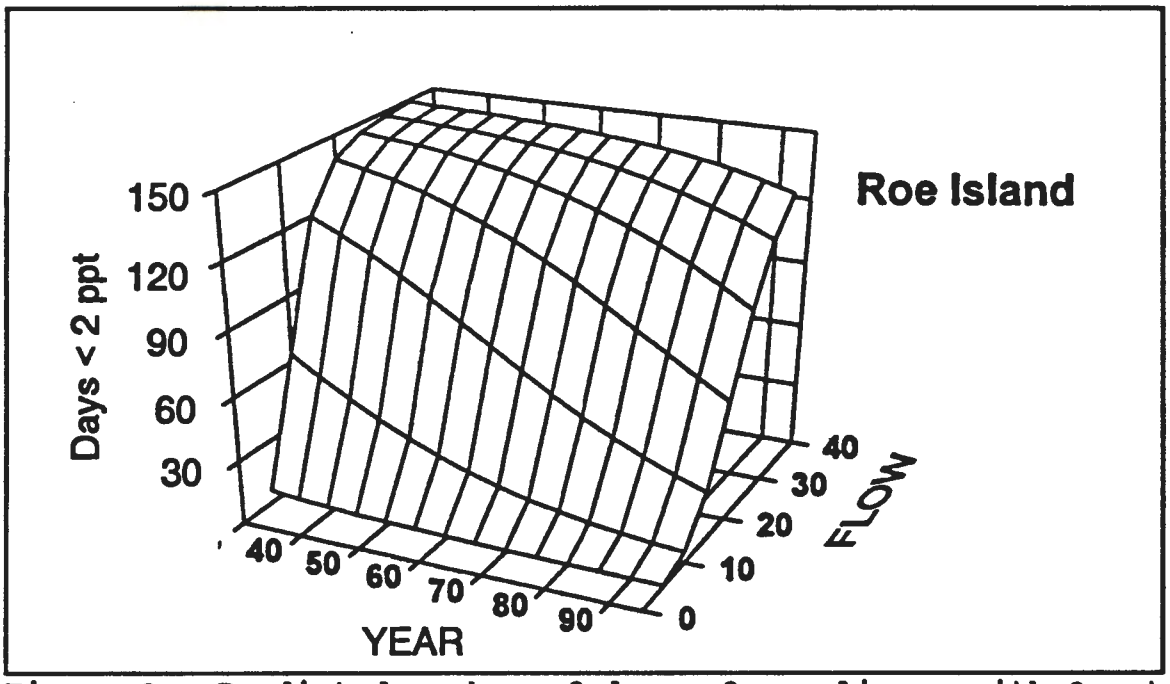

Figure 2. Predicted number of days of compliance with 2 ppt criteria during Feb-Jun period, showing relationship to (1) increasing level of development represented by calendar year and (2) unimpaired flow.

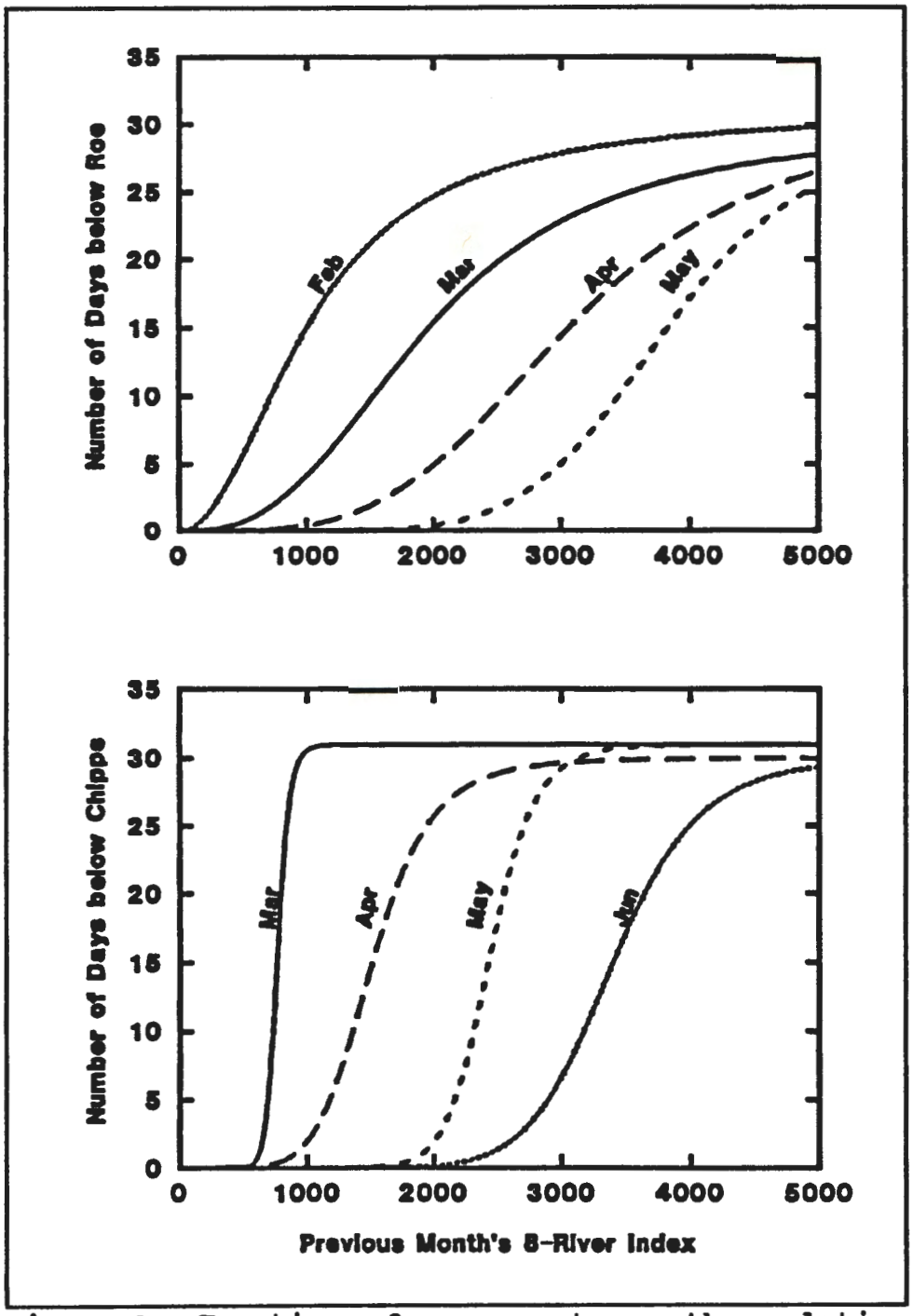

Figure 3 Equations for separate months relating previous month's unimpaired flow to current month requirement.

Final
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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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COMMENTS OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY TO THE STATE WATER RESOURCES CONTROL BOARD AT THE FIFTH PUBLIC WORKSHOP FOR THE REVIEW OF STANDARDS FOR THE SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA ESTUARY

SEPTEMBER 1, 1994

At the last Board workshop, EPA summarized the extensive discussions with the parties that have taken place since our proposed standards were announced last December. We also described some of the modifications to those standards that we have developed in an attempt to reduce their water supply impacts while maintaining our targeted level of protection. Once again, we would like to thank the staffs of the various agencies and interests that contributed their time and energy to this process. Although several significant differences remain among the parties, we are encouraged by the progress we have made to date, and urge the Board to build upon these efforts in its development of State standards.

In December 1993, EPA proposed three sets of water quality standards for the estuary as part of a coordinated set of federal actions. In the past several months, we have been reviewing the comments received on the proposed rule, and working with a broad spectrum of interested parties in developing the final rule.

Today, we are making available several documents that explain in detail our current staff recommendations with respect to the final standards. The first set of documents were contained in a Notice of Availability that was published in the Federal Register last Friday; the second set were part of a letter sent earlier this week from EPA to FWS and NMFS as part of the Endangered Species Act consultation process.

The recommendations in these documents are, of course, preliminary. They represent staff recommendations only and have not received final management approval. Nevertheless, we believe it is important for the State Board and other parties to be apprised of our efforts as we all work towards adoption of mutually acceptable standards.

The staff recommendations include four sets of water quality criteria:

1. Estuarine Habitat

The first are the 2 ppt salinity criteria at Roe Island, Chipps Island, and the confluence of the Sacramento and San Joaquin Rivers. Based on extensive discussions with DWR, CCWD, and other parties, we have developed two major modifications to the Estuarine Habitat criteria described in the proposed rule: a sliding scale to replace the five water year classifications, and three alternative methods of compliance at the Roe Island and Chipps Island stations: daily salinity, 14-day average salinity, and the equivalent daily outflow. These modifications have been endorsed by a broad range of interests.

2. Fish Migration

The second set of criteria are Fish Migration criteria to protect salmon smolts and other migratory species in the Delta.

After the close of the public comment period, EPA participated in a series of three scientific peer review workshops on these criteria organized and facilitated by the urban and environmental interests. Several participants in the workshops raised concerns about using predicted model results as the basis for these criteria. The group agreed that goals for salmon smolt survival should be based on the actual fall-run salmon smolt survival index (SSI) rather than predicted model results.

Based on these discussions, EPA has developed an alternative methodology for the Fish Migration criteria that is based on measured survival rates. The new methodology is described in two documents published in the Federal Register last week: 1) The summary of the three scientific peer review workshops on the Fish Migration criteria sponsored by the urban and environmental interests in June, and 2) A description of an alternative set of criteria based on the conclusions of those workshops. The target values for the new set of criteria reflect an achievable set of implementation measures, and are generally consistent with the doubling goal established by the CVPIA and state legislation.

The workshop participants also discussed how these criteria might be implemented. There was general agreement that a specified salmon smolt survival goal should be coupled with a set of implementation measures designed to achieve the goal, including gate closures, increased flows, export limits, and other measures. The goals would be revisited during the triennial review process to determine the effectiveness of the measures. The implementation measures could then be modified as appropriate to achieve the goals, on average, over a period of years.

We believe this approach will ensure that the designated uses are protected, while providing the flexibility necessary to experiment with different approaches to improve survival. In recent Board workshops, several parties have stressed the importance of developing real-time monitoring programs and studies

to evaluate the effectiveness of innovative control measures, such as the sound barrier on Georgiana Slough. By combining goal-setting with an adaptive management process, we can provide a mechanism for the State Board to incorporate the results of these and other ongoing studies into its implementation plan without modifying the approved criteria.

3. Fish Spawning

We are also recommending salinity criteria to protect Fish Spawning and other fish and wildlife uses of the lower San Joaquin River from Jersey Point to Vernalis. The purpose of these criteria is to address increased salinity levels caused by agricultural return flows in the San Joaquin Valley.

In the preamble to the proposed rule, we suggested that these criteria were likely to be implemented by increased flows on the lower San Joaquin River. That statement was based on an analysis by the Board staff which concluded that the measures proposed to protect salmon in Draft Decision 1630 would also be adequate to meet these salinity criteria. Several commenters took issue with these statements, and suggested that these criteria should be implemented through reductions in salt loadings from agricultural return flows. EPA agrees with these commenters, and recommends that the Board develop an implementation plan that builds upon the recommendations of the San Joaquin Valley Drainage Program and EDF's recent proposals to use economic incentives to achieve compliance with the criteria. Through this approach, the Board can ensure the criteria will not have any additional impacts on water supplies.

Some parties have suggested that these criteria are inconsistent with an ecosystem-based protection plan for the estuary, and may have adverse impacts on some species. We disagree. We do not believe that setting criteria to reduce the impacts of salt loadings on spawning habitat for sensitive species, including striped bass and Sacramento splittail, is in any way inconsistent with an ecosystem-based approach. We are also not aware of any evidence that reductions in salt loadings would have adverse impacts on other species. In fact, we note that several parties, including the California Urban Water Agencies (CUWA) and the Association of California Water Agencies (ACWA), have recommended reductions in salt loadings as part of their comprehensive protection plans for the estuary.

4. Suisun Marsh Tidal Wetlands

The final recommended criteria is a narrative criteria to protect the tidal wetlands surrounding Suisun Bay. You may recall that EPA's approval of the 1978 Delta Plan was conditioned, in part, upon the Board's commitment to develop standards to protect aquatic life and the brackish tidal marshes surrounding Suisun Bay. Because these commitments were not met, EPA specifically disapproved the State's salinity criteria for the Marsh because

they were not adequate to protect Estuarine Habitat, Wildlife Habitat, Rare and Endangered Species, and other fish and wildlife uses of the Marsh.

In the proposed rule, EPA included two possible narrative criteria for the tidal wetlands, and solicited comment on whether these or other criteria should be included in the final rule. Based on the comments received, we have further refined this narrative criteria. It provides that water quality conditions be sufficient to support high plant diversity and diverse wildlife habitat, to prevent conversion of brackish marsh to salt marsh, and to protect and maintain sustainable populations of those species vulnerable to increases in water and soil salinity.

We believe that this criteria serves several important purposes: 1) It fulfills our responsibility to set standards for the tidal marshes; 2) It addresses concerns raised in the Endangered Species Act consultation process regarding the protection of candidate species dependent upon brackish marsh habitat; 3) It provides a clear statement that the tidal marsh community should be protected in any comprehensive ecosystem-based protection plan for the estuary; and 4) It provides an incentive for new and ongoing studies of the Marsh to be completed, as the Board recommended in the 1991 Plan.

In the 1991 Water Quality Control Plan, the Board noted that a biological assessment is needed to determine the water quality requirements of the rare, threatened, and endangered species in the managed and unmanaged wetlands around Suisun Bay. The Plan stated that the Board would develop amendments and additions to the existing numeric criteria based upon the results of this assessment, and then, in a later action, assign responsibilities for meeting any changed standards. EPA supports this approach, and encourages the Board to work with DWR, DFG, and others to complete the assessment before the next triennial review. The narrative criteria will provide a framework for these studies, and ensure that protective criteria are in place pending the development of revised numeric criteria for the Marsh.

That concludes my summary of EPA's staff recommendations. Again, each of these criteria are explained in more detail in our letter to FWS and NMFS, and in our Federal Register notice regarding the Fish Migration criteria.

Thank you again for hearing our comments. We appreciate this opportunity to contribute to the State Board's process, and look forward to working with you and your staff in developing approvable State standards.

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AN AFFIRMATIVE ACTION EMPLOYER

September 1, 1994

Palma Risler
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105-3901

Dear Palma:

Subject: Demand level utilized in the DWRSIM model simulations to identify the water supply impacts of the EPA's proposed water quality standards in the Delta for the RIA. Project number 2-9579-102.

Introduction

In the Analytical Framework that the Environmental Protection Agency (EPA) issued for evaluating the water supply and economic impacts of the EPA's proposed water quality standards in the Sacramento-San Joaquin River\San Francisco Bay Delta Estuary (Delta) dated July 11, 1994, the EPA requested detailed comments on the stipulated demand level modeled in the operation simulations by the California Department of Water Resources (DWR). This letter is the Santa Clara Valley Water District's (SCVWD) response to the EPA request and is to be considered a part of the official comments that are being submitted by SCVWD on the revised EPA water quality standards for the Delta.

Summary

By utilizing a historical demand level of 6.0 million acre feet per year (MAF) for the operations simulations of the EPA's proposed standards by DWR, EPA is in essence placing an export cap on the State Water Project (SWP) and Central Valley Project (CVP). The stipulated demand assumption leads to a basic question, "Does the EPA want to limit economic growth in the State of California ?" While it is beneficial to compare the estimated water supply reductions and the resulting economic costs for the Regulatory Impact Analysis (RIA) based upon the demand level that was used in the initial RIA, using the historical demand level of 6.0 MAF in the operation simulations understates the water supply and economic impacts of EPA's proposed standards. Utilizing a historical export demand level on the projects also provides an unreasonably favorable bias as to the physical feasibility and water supply benefits of the north-to-south water transfer alternative assumed by the EPA to mitigate the water supply impacts of the EPA's proposed standards.

Historical deliveries from the two projects, especially the SWP, are not limited by supply as stated by the EPA, but by a combination of historical entitlement obligation, requests for deliveries, and hydrology. Figure 1 illustrates the relationship between the SWP historical entitlement, requests for deliveries, and actual deliveries. Over the period of interest, 1970 to 1993, several factors served to limit actual deliveries. Historical entitlement obligations did not allow the SWP to export available water. Wet hydrology throughout the State during the early and mid-1980's served to reduce the requests for deliveries by contractors on the SWP. And, dry hydrology during the late 1980's and early 1990's limited deliveries even though requests for delivery increased dramatically during this period.

An export cap on the projects of 6.0 MAF unfairly and severely penalizes the SWP for coming on line at a later point in time than the CVP. If the SWP exports are limited, the project still has the legal obligation to distribute available supply to contractors based on the contractors' respective entitlement. When the SWP reaches full entitlement levels, the pool of available water that can be exported by the SWP in any given year will be distributed on the basis of project entitlement obligations. The contractors would receive less water in the future than what they would receive today under the same hydrologic conditions. Because the CVP came on line and reached full entitlement obligations before the SWP, the CVP would not be penalized in this same manner. The CVP deliveries may be limited in the future, but the deliveries would not be re-allocated (reduced) because the CVP is currently at full delivery obligations.

The unreasonably favorable bias as to the physical feasibility and water supply benefits of the north-to-south water transfer alternative which is intended to mitigate the water supply impacts of the EPA's proposed standards are based on the available excess pumping capacity at the Banks pumping plant under a 2.9 MAF demand level. Physically, the lower the export demand level on the SWP, the more pumping capacity is available for transfers. Existing entitlement obligations on the CVP and SWP should be used to provide an accurate and fair assessment of available pumping capacity for the north-to-south Delta transfer alternative.

Historical Deliveries of SWP

The 6.0 MAF/yr export demand level in the DWRSIM model has been justified on historical deliveries. However, there are several points that need to be considered before assuming 6.0 MAF/yr represents the existing export demand level.

Since the SWP is not complete and the contractors have yet to reach full entitlement levels, the flexibility in setting any export demand level for modeling purposes revolves around the SWP. In the DWR simulations, the 6.0 MAF/yr split between the two projects are set at 3.1 MAF/yr for the CVP, and 2.9 MAF/yr for the SWP. Figure 1 illustrates the historical south of the Delta contractor SWP entitlement, requests for deliveries, and actual deliveries. The relationship between these variables provides the context in which to examine whether or not the SWP contractor's deliveries are limited by supply as stated by the EPA, or if other factors have occurred which have limited actual deliveries. The following points can be made:

- The 1995 SWP export contract entitlement is 4.1 MAF/yr
- Exports of 2.9 MAF/yr represent the 1985 contractor entitlement level on the SWP
- Historical deliveries have been less than historical requests for deliveries due to a combination of water quality regulations, fish and wildlife requirements, and hydrology
- Until 1992, historical requests for delivery have been less than contract entitlement because local demand had not needed the contractor entitlement but population growth requires this entitlement
- Over a five year period (1987-1992), contractor requests for SWP water increased from 2.5 MAF/yr to 4.1 MAF/yr matching entitlement levels, an increase in requests of 40 percent

- Maximum deliveries of 2.8 MAF/yr on the SWP (Banks pumping plant) in 1989 were based upon a requested export delivery level of 2.8 MAF/yr
- During the wet period of 1982-1987, requests for SWP export deliveries were less than entitlement because contractor's local storage south of the Delta facilities had been filled by local runoff during this wet period of hydrology
- During the first three years of the 1987-1992 drought, requested deliveries were less than entitlement because local carryover storage, supplies, and conservation programs were utilized to meet local need
- The SWP schedule of entitlement was developed during the 1968-1992 time period which coincided with the design and construction of the project's conveyance and storage facilities
- The SWP Banks pumping plant was not capable of delivering contractor obligations until the recent installation of additional pumping capacity (1992)

The significance of these issues should not be dismissed when defining the existing net export demand level in the Delta for the CVP and SWP. These facts need to be considered explicitly to define the actual near term and long term water supply impacts of the EPA's proposed water quality standards.

The combination of the statewide wet hydrologic period preceding the drought, the dry hydrology during the drought, the Delta water quality and regulatory requirements, and the physical pumping and conveyance limitations of the SWP happened to coincide to establish the SWP historical export delivery level from the Delta. It is therefore incorrect to simply characterize the historical deliveries from the SWP as being limited by supply, as stated by the EPA. It is more appropriate to state that the SWP historical deliveries were limited by D1485 and a lack of local or regional storage south of the Delta that could take advantage of excess water conditions during wet periods of hydrology prior to entering the most recent drought.

Implications of Low SWP Export Demand Level

By modeling the SWP export demand level at 2.9 MAF/yr the SWP would be severely penalized. Even though the SWP exports are limited, the project still has the legal obligation to distribute available supply to contractors based on the contractors' respective entitlement. For example, if the large SWP contractors (Metropolitan Water District or Kern Water District) request full entitlement, the pool of available export water would be essentially sliced into smaller pieces for all contractors on the project. It should be noted that the SWP historical requests for delivery increased dramatically from 1989 to 1992 because Metropolitan increased their delivery requests to their full entitlement, from approximately 1.1 MAF/yr to 2.01 MAF/yr over the three year period. Prior to 1989, MWD did not request full entitlement deliveries.

Water Supply Transfer Alternative

The available pumping capacity for north to south water transfers is dependent upon the level of export demand on the SWP because the CVP pumps only have enough capacity to meet their existing export demand level (3.1 MAF/yr). Thus, any transfer pumping capacity lies with the SWP.

By utilizing a 6.0 MAF/yr export demand level for the two projects (eg. 3.1 MAF/yr for the CVP and 2.9 MAF/yr for the SWP), the water transfer alternative outlined in the RIA becomes more physically and economically feasible. Physically, the lower the export demand level on the SWP, the more pumping capacity is available for transfers. Economically, the transfer alternative becomes more attractive because the SWP and CVP economic impacts are evaluated on a historical export level (1985) while local agencies are required to evaluate their shortages on the existing local demand level (1995). The adverse economic impacts are further magnified by the higher local demand level for 2010.

The costs of the transfer alternative also does not take into consideration capital expenditures that the local agencies will have to simply maintain the existing water supply reliability within their respective service areas. There is an implicit assumption in the EPA's transfer alternative that recipients of transfer water will have the facilities to store transfer water. This is not necessarily the case and storage may well be the constraint on the feasibility of the water transfer alternative to supplement the export shortages of the two projects.

Recommendations

The EPA's proposed analytic framework for estimating the economic impacts of the EPA's proposed standard in the Delta should incorporate the existing export demand level on the SWP and the CVP. Currently, the CVP is modeled at the 1995 export demand level and the SWP is modeled at the 1985 export demand level.

Evaluation of the water supply impacts for the SWP, CVP, and the local agencies needs to occur at the same level of development. While the local agencies are required to evaluate their water supply shortages and the resulting economic impacts on the 1995 level of development, the EPA uses a historic export level (1985 for the SWP) from the Delta on which local agencies must base their supply analysis. This different mix of state and local water demand levels introduces inconsistencies and results for the critical dry period and long term water supply impact analysis.

Utilizing a historical export demand level from the two projects for a 2010 level of development economic analysis does not consider the delivery obligations of the SWP. The requests for deliveries on the SWP will continue to rise. The assumption of using a 2010 6.0 MAF/yr export demand level for the two projects from the Delta completely dismisses the effect of increasing delivery obligations over time, which result in reduced deliveries to the project contractors because shortage allocations are based upon entitlement.

It would be more representative of actual SWP and CVP operations in the DWR modeling to utilize a variable export demand level. During dry hydrologic periods, higher export demand levels need to be modeled. During wet hydrologic periods, lower export demand levels can be modeled.

Finally, any export demand level modeled by DWR needs to be based on the actual delivery obligations of the two projects to accurately reflect what is occurring within the service areas of the SWP and CVP.

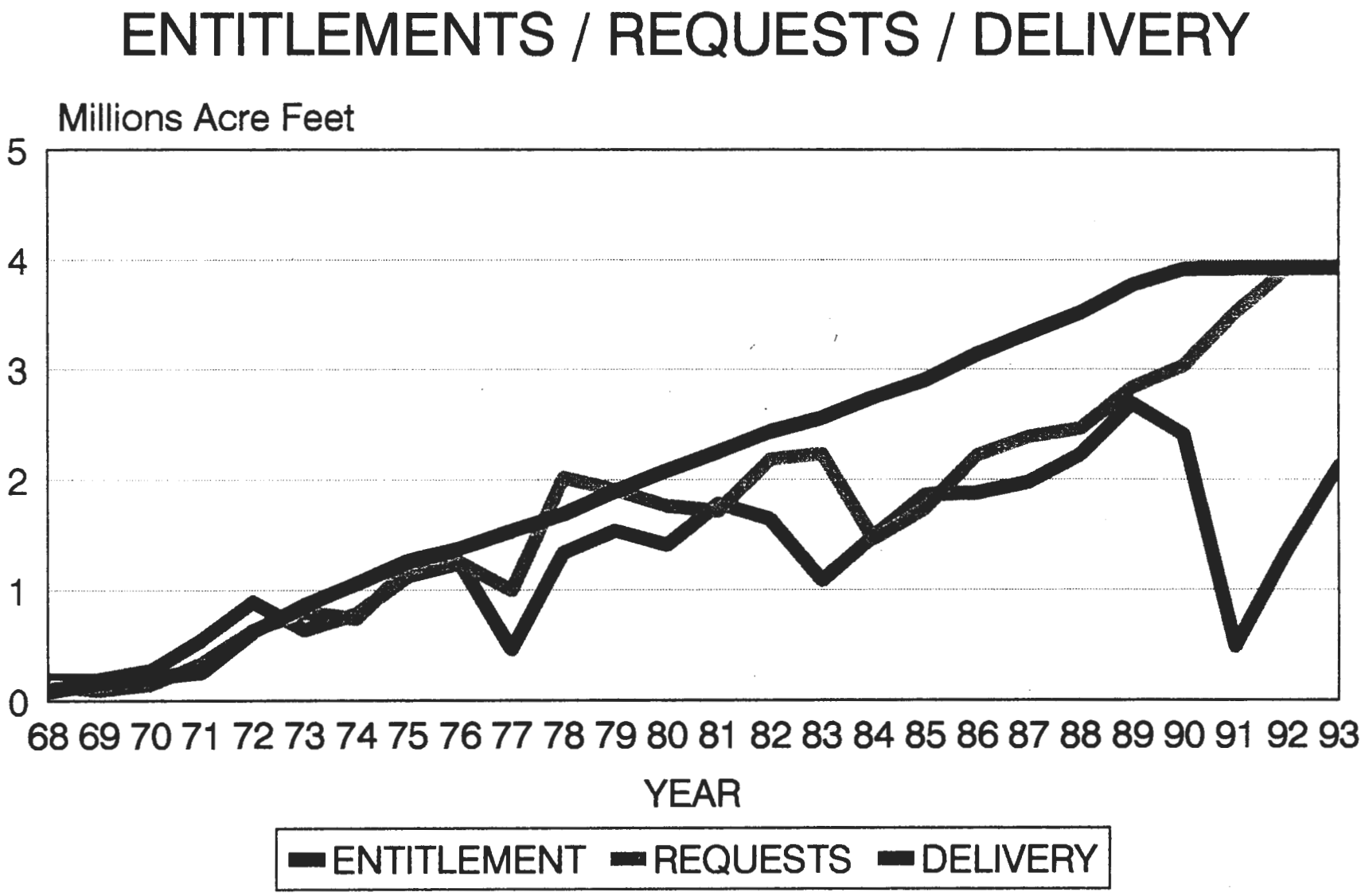
Not to do so, misrepresents the water supply impacts of EPA's proposed water quality standards on the two projects.

Sincerely,

Vincent M. Stephens
Associate Engineer
Water Resources Development Division

Enclosure

Figure 1. SWP BANKS PP OBLIGATIONS



Santa Clara Valley Water District

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AN AFFIRMATIVE ACTION EMPLOYER

September 1, 1994

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Water Resources Development Division

Enclosure

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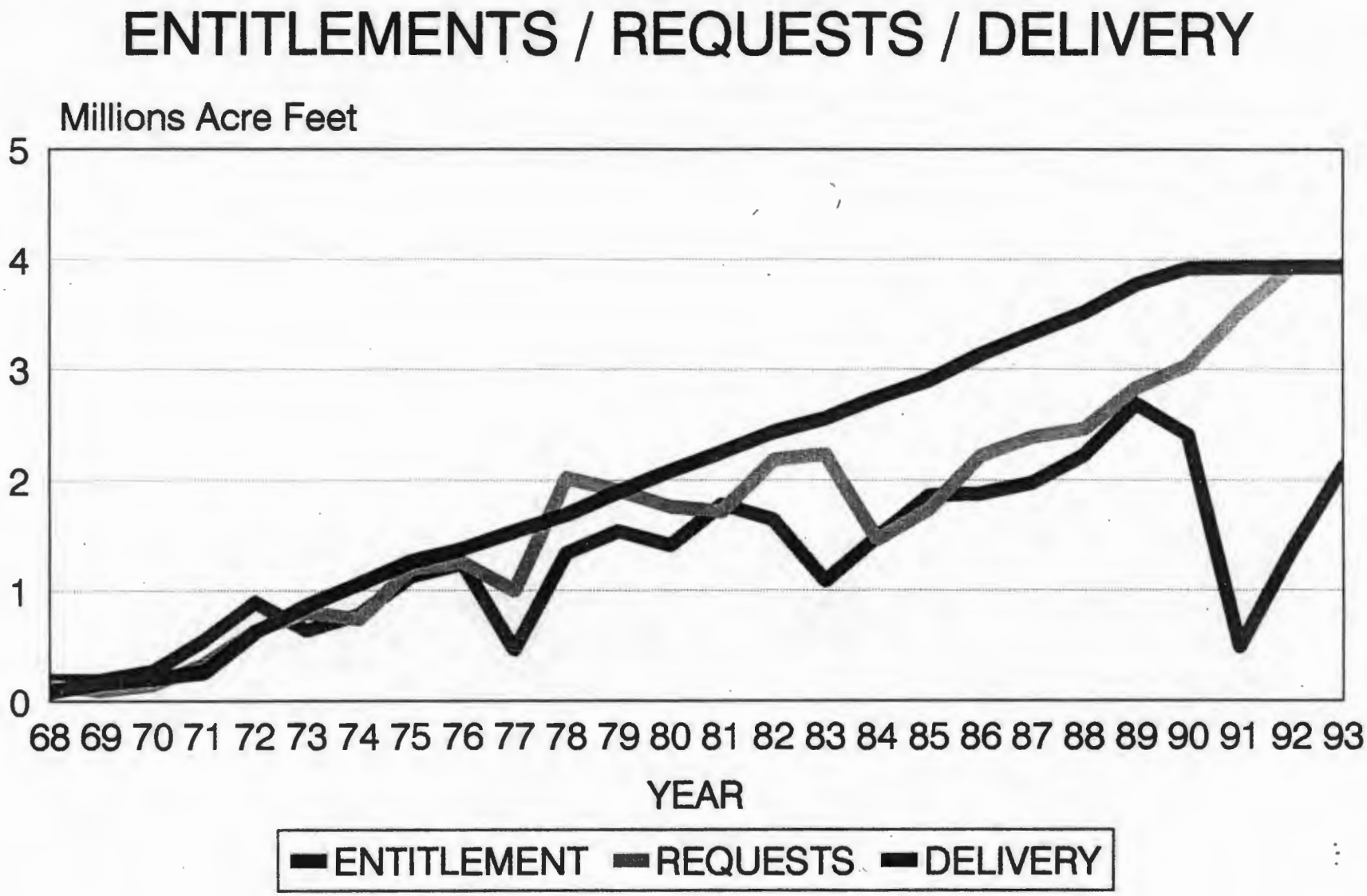

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AN AFFIRMATIVE ACTION EMPLOYER

September 1, 1994

Palma Risler
Water Management Division
Bay-Delta Section
U. S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, California 94105

Dear Ms. Risler:

Subject: Proposed Federal Water Quality Standards for the San Francisco Bay/Sacramento-San Joaquin River Delta

The U.S. Environmental Protection agency (EPA) has requested comments on the revised water supply and economic impacts of the proposed water quality standards for the San Francisco Bay/Sacramento-San Joaquin River Delta. Contained herein are detailed comments on the estimated water supply impacts to Santa Clara County based on the latest EPA alternative. The associated economic impacts will be transmitted upon completion.

If you have any questions regarding the water supply impacts or economic impacts that have been identified, please contact Vince Stephens at extension 2439 or John Ryan at extension 2402.

Sincerely,

Jim Fiedler
for Leo Cournoyer
Water Supply Manager

SANTA CLARA VALLEY WATER DISTRICT

ESTIMATED WATER SUPPLY and ECONOMIC IMPACTS DUE TO THE ENVIRONMENTAL PROTECTION AGENCY'S PROPOSED WATER QUALITY FEDERAL STANDARDS IN THE SAN FRANCISCO/SACRAMENTO-SAN JOAQUIN RIVER DELTA

September 1, 1994

SUMMARY

The Federal Environmental Protection Agency (EPA) is under a court mandate to issue new water quality regulations for the San Francisco Bay/Sacramento-San Joaquin Delta (Delta) estuary. The proposed regulations are expected to reduce water supplies available for export from the Delta by the State Water Project (SWP) and the federal Central Valley Project (CVP).

The Santa Clara Valley Water District has identified the direct water supply and economic impacts to Santa Clara County due to the EPA proposed water quality standards and revised compliance criteria in the Delta. The supply and economic impacts identified herein represent a supplement to the initial submittal from the Santa Clara Valley Water District (SCVWD) to the EPA's request for comments on the EPA's proposal to adopt federal water quality criteria for the Delta, dated March 8, 1994.

The incremental water supply reductions that have been identified are based on the existing State Water Resource Control Board's (SWRCB) D-1485 standards, National Marine Fisheries Service (NMFS) winter-run salmon protection requirements, and the EPA proposed isohaline, winter-run salmon, and Striped Bass spawning standards. The supply impacts are the delivery reductions to Santa Clara County's imported water deliveries from the SWP, federal CVP, and the City and County of San Francisco's Hetch Hetchy system due to EPA's proposed standards.

Direct Supply Impacts

The total estimated near-term (1995) direct incremental imported water supply reductions to Santa Clara County range from 15,000 acre-feet per year (AF/yr) over the historical period of study (1922-1992) and 37,000 AF/yr during the state historical critical dry period (1928-1934). The long-term (2010) direct incremental water supply impacts are 62,000 AF/yr over the historical period of study and 81,000 AF/yr for the state historical critical dry period.

Supplemental Supply Requirements

Supplemental water supplies are not needed in the near term (1995) due to the Santa Clara Valley Water District's (SCVWD) conjunctive use of its groundwater supply, conservation programs, and reclaimed water supply. However, by the year 2010, even with optimization and maximization of the County's conjunctive use system, permanent conservation and full implementation of demand side management programs, and development of reclaimed water, the incremental supplemental supply requirements associated with EPA's proposed standards would be 12,000 AF/yr on the long-term average and 28,000 AF/yr during a critical dry period.

The SCVWD estimates that total supplemental supplies of 130,000 AF/yr will be required to meet the County's needs because of D-1485, NMFS, and EPA standards during a critical dry period in the year 2010.

Economic Impacts

For the year 2010, the costs associated with the water shortages that would occur during a critical dry period would range from $10,000,000/yr to acquire transfer water to $56,000,000/yr in welfare losses that would result from a water shortage. If borne by the SCVWD, these costs represent 16 percent and 90 percent of the SCVWD's current annual operating budget of $62 million/yr. The magnitude of these expenses could result in rate increases ranging from 20% to 50% when passed on to the County's water retailers.

The Central Valley Project Improvement Act

The water supply and economic impacts that have been identified due to the proposed EPA standards are separate from the water supply impacts associated with recent federal reform legislation, the Central Valley Project Improvement Act (CVPIA). Estimates for the supply reductions that will occur due to implementation of the CVPIA are not yet available. However, there is no doubt that the anadromous fish doubling provisions contained within the Act will reduce the firm yield of the CVP substantially, further eroding the reliability of Santa Clara County's imported water supplies. It is incorrect for the EPA to simply dismiss the cumulative water supply and economic impacts of federal actions intended to improve the Delta, Sacramento River, and the San Joaquin River aquatic ecosystems. Estimates of the CVPIA water supply impacts need to be addressed in the EPA Regulatory Impact Analysis to establish the proper basis from which to evaluate the water supply and economic impacts due to EPA's proposed standards. The cumulative effects of the EPA standards and the CVPIA could have significantly greater impacts on water supply and regional economies than the proposed EPA standards.

WATER SUPPLY IMPACTS

The following sections document Santa Clara County's imported water supply reduction due to EPA's proposed water quality standards in the Delta.

County Water Needs

The 1987 pre-drought Santa Clara County water needs were 393,000 AF/yr. Due to the continuing effect of the drought, coupled with the water savings of the County's citizens, the SCVWD estimates that Santa Clara County's 1995 water supply needs will be 375,000 AF/yr. Based on projected population growth estimates Santa Clara County will have a total water supply need of approximately 490,000 AF/yr by the year 2010.

Water Supply Sources

The County receives its water supply from local and imported sources. The local supply accounts for approximately 30% to 50% of the County's water supply and consists of surface water from local reservoirs (artificially recharged to the groundwater basin), natural groundwater recharge, and

reclaimed water. The SCVWD has operated an intensive conjunctive use groundwater supply and distribution system since 1936 when the first local water supply reservoirs were constructed to augment the County's natural groundwater supplies and arrest the extensive subsidence problem in the valley. If subsidence were to begin again, it is estimated that $153 million dollars in damage would occur in the north County due to expenditures associated with collapsed water well casings, required sanitary sewer improvements, bridge raising, increased drainage pumps, channel levee improvements, and bayland levee improvements. To maintain the County's groundwater basin, the SCVWD intends to artificially recharge 116,000 AF of local and imported water this year.

Table A identifies the estimated amount of local and imported supplies available on a long-term average basis and during a state critical dry period from the SWP, the CVP, and the Hetch Hetchy system. The SCVWD SWP and CVP supply estimates are based on the most recent state Department of Water Resources (DWR) operations studies for the Delta utilizing the State Water Resources Control Board's D-1485 standards and the National Marine Fisheries Service winter-run salmon requirements.

Water Conservation

Santa Clara County's demand side management is achieved through state plumbing code requirements and Best Management Practices (BMP's) for conservation. State plumbing codes currently in effect require the use of water saving plumbing fixtures in new residences. It is estimated that the plumbing code water conservation benefits for the County will be approximately 23,000 AF/yr by 2010.

Demand side management of the County's water needs includes permanent water conservation measures designed to be implemented over a 10-year period (1991-2001). As a signatory to the Memorandum of Understanding Regarding Urban Water Conservation in California, the SCVWD has joined over 80 other water agencies throughout California committed to aggressively promote water conservation. SCVWD has committed to implement 16 Best Management Practices (BMPs) and estimates that permanent water savings from those BMPs will save approximately 28,000 AF/yr by the year 2002. By the year 2010, additional BMPs are estimated to save approximately 14,000 AF/yr for a total water savings of 42,000 AF/yr. The estimated 1995 permanent water conservation associated with the implementation of BMPs are 12,000 AF/yr.

During the recent drought, Santa Clara County was able to attain a countywide conservation level of 22 to 30 percent, based on the 1987 demand level, for an average of 74,000 AF/yr of conservation savings. Due to the permanent conservation effects of plumbing code requirements and the implementation of BMP's, demand hardening will reduce the amount of water that can be conserved during a future dry period. The SCVWD has estimated that a future countywide conservation level of 10 percent would represent the equivalent of today's conservation level of 25 percent.

Reclaimed Water

The SCVWD encourages and financially supports the development of reclaimed water through its Nonpotable Reclaimed Water Policy. Through the policy, the District is committed to contributing financial support which equates to an avoided cost to the District of $355/AF for water delivered from nonpotable reclaimed water projects that replaces water provided by the SCVWD. Currently, there are four wastewater treatment facilities in the County producing nonpotable water for reuse. Plans

for expanding the nonpotable reclaimed water supply and distribution system to serve the majority of the potential market are currently under development.

Two types of reclamation projects are being investigated to supplement the County's water supplies; nonpotable reclamation and groundwater recharge of reclaimed water. It is estimated that countywide nonpotable reclamation projects will be able to supplement SCVWD's water supply by about 17,500 AF/yr by the year 2010 and 32,000 AF/yr by 2020.

In a joint study with the City of San Jose, SCVWD identified up to 25,000 AF/yr of reclaimed water that could potentially be developed for groundwater recharge under water quality criteria being developed by the State Department of Health Services. The amount of potable reclaimed water that can be utilized in the County's supply and distribution system is limited by the natural storage capacity of the groundwater basin during wet periods of hydrology and the availability of surface water that must be blended with reclaimed water for recharge to the groundwater basin during a critical dry period. If the SCVWD local reservoirs are empty due to drought effects, the only water available for blending with potable reclaimed water is imported water obtained under existing contracts or supplemental water transfers. Thus, water transfers would be an essential component of the potable reclaimed water supply alternative for Santa Clara County.

Net County Water Needs

Based upon water needs projections, reclamation, and the implementation of plumbing code and water conservation BMP's, the County's net water supply needs are summarized in Table B for the County's 1995 and 2010 demand level.

Estimated County Water Supply Impacts due to the Proposed EPA Standards

The impacts on the County's imported water supply due to the EPA's proposed standards have been estimated using DWR studies of the SWP and CVP contractor deliveries from the Delta over a historical study period (1922-1992). Three DWR studies were used to identify the incremental water supply impacts associated with existing and proposed water quality standards in the Delta. The three studies utilized were: (1) the base case reflecting the State Water Resource Control Board's D-1485 standards (study 275), (2) the National Marine Fisheries Service (NMFS) winter-run salmon requirements (study 279), and (3) the proposed EPA standards (study 280).

The SCVWD full project entitlements are 100,000 AF/yr and 152,500 AF/yr from the SWP and CVP, respectively. Tables C and D presents the anticipated SCVWD water supplies from the SWP and CVP associated with Delta water quality standards for two hydrologic periods, the long-term average and the state critical dry period. The estimated deliveries are based on a demand export level on the projects of 6.0 MAF/yr as stipulated by the EPA in the Analytical Framework for revising the Regulatory Impact Analysis. It should be noted that estimating the water supply deliveries based on an export demand level of 6.0 million acre-feet/yr (MAF/yr) on the projects, represents a historical project export demand level. Therefore, the historical demand level in the DWR model understates the water supply impacts over the long-term average and critical dry period. For 1995, the SWP and CVP total south of the Delta contractor entitlement obligations on the two projects are estimated to be 7.1 MAF/yr.

To estimate the SCVWD's imported water supply impacts due to EPA's proposed standards, the proportional amount of SWP and CVP export deliveries to Santa Clara County used the three DWR operational studies. For the SCVWD estimated SWP deliveries, the SWP shortage rules on the DWR estimated contractor deliveries were utilized. For the SCVWD estimated CVP deliveries, the upper Delta Mendota Canal conveyance losses and Level II refuge water were deducted from the total DWR estimates for contractor deliveries. The Level II refuge water was utilized in both the 1995 and 2010 time periods for the CVP. The SCVWD CVP water supply estimates include the delivery priority of the San Joaquin River exchange contractors on the CVP system. The SCVWD did not assume a Municipal and Industrial shortage policy when estimating the CVP deliveries to Santa Clara County.

Based on the EPA's stipulation that the near-term (1995) and long-term (2010) supply impacts be evaluated on the project's modeled export demand level of 6.0 MAF/yr, SCVWD assumed in its delivery impact analysis that export water from the Delta would be limited because of project operational and environmental restrictions. However, since the two projects have increasing entitlement obligations over the long-term (7.6 MAF/yr in 2010), the long-term demands on the projects needed to be incorporated into the analysis. This was done by proportionally reallocating the water available to each contractor based on the 2010 entitlement obligation of the projects.

The County's Hetch Hetchy supply reductions are associated with the pulse flow requirements on the San Joaquin River watershed for the winter-run salmon. Table E identifies the estimated 1995 and 2010 reductions in SWP, CVP, and Hetch Hetchy deliveries to Santa Clara County due to the proposed EPA standards.

The reductions in imported water supplies that would result from the proposed EPA regulations do not translate directly into additional water needs. Because of local supplies and surface and groundwater storage capacity, the County's incremental water needs are less than the estimated reductions in imported supplies. For a critical dry period, the supply reductions shown in Table E result in the following needs for additional supplies:

	1995	2010
Reduction in Imported Supply	37,000	81,000
Supplemental Supplies Needed	0	28,000

Water Year Type Supply Impacts

The EPA has requested that the water supply impacts of the proposed standards be identified by water year type. Table F identifies the estimated near-term (1995) incremental SWP and CVP water year type average delivery reductions to the SCVWD that would occur due to the EPA's proposed standards. Supply reductions range from about 2,850 AF/yr for wet years to 26,000 AF/yr for critical years. Table G identifies the estimated long term (2010) incremental water year type SWP and CVP water delivery reductions to the SCVWD that would occur due to EPA's proposed standards. Average supply reductions range from approximately 36,000 AF/yr for wet years to 55,000 AF/yr for critical years.

Project and Non-project Contribution to Meet EPA Standards

The EPA also requested that the local agencies investigate the water supply impacts of a pro-rata sharing scenario with non-project operators to meet the proposed EPA standards. It is not possible to investigate the water supply impacts of a sharing scenario without DWR modeling such an arrangement. For example, a sharing arrangement of 80 percent and 20 percent between the project and non-project operators does not translate directly into a one to one supply benefit for the project operators. The amount of water that can be exported from the Delta is dependent upon both the water entering the Delta and non-project operators contributing flows for the purpose of meeting the EPA standards. This would change the historical hydrology utilized in the modeling process.

It should also be noted that Santa Clara County's Hetch Hetchy supplies may be further impacted by a non-project flow contribution to meet the X2 standard. Currently, it has been proposed that Hetch Hetchy be required to contribute to in-stream pulse flows on the Tuolumne River to meet EPA's proposed salmon smolt survival criteria. Any additional supply impacts to Hetch Hetchy due to the X2 standard would require that SCVWD obtain additional supplemental supplies to make up for the shortfall.

Supply Uncertainty

The supply impacts that have been identified are not complete because there are two additional considerations that currently cannot be quantified. The first consideration is that under the Endangered Species Act "take limits" for the endangered winter-run salmon or Delta smelt, scheduled SWP and CVP contractor water deliveries from the southern Delta can be interrupted. The result of suspending the scheduled deliveries has a two-fold effect: 1) The water supplies that were scheduled to be delivered for the period of interruption need to be made up at a later time and 2) the scheduled water that does need to be delivered at a later time would be prioritized before water transfers. The effect of this is to reduce the opportunity to transfer water through the Delta to mitigate for the water supply impacts associated with the EPA's proposed Delta water quality standards.

SCVWD has serious concerns about the viability of transferring water through the Delta due to the regulatory constraints on the projects imposed by the ESA. This is an issue that needs further analysis and review to determine when transfers can occur and what effect the "take limits" on winter-run salmon and Delta smelt would have not only on scheduled deliveries but on the opportunity to transfer water.

The second uncertainty is the water supply impacts associated with the Central Valley Project Improvement Act (CVPIA). The act requires that 800,000 AF/yr of firm yield from the CVP be designated for environmental purposes. It is not clear how this water could be used to mitigate some of the supply impacts associated with the NMFS criteria or the proposed EPA standards. The CVPIA requirements may further reduce the amount of water available for export by the CVP.

SCVWD Water Supply Planning

The SCVWD is responsible for providing an adequate supply of water, both in quantity and quality to meet the present and future needs of the County.

SCVWD believes that in order to meet its responsibilities, it is necessary to meet the County's water supply needs under all hydrologic conditions, including a critically dry period.

This year (1994) the District purchased additional water supplies from the state Drought Water Bank to meet the water supply needs of Santa Clara County. Due in part to environmental restrictions in the Delta, the District received only 50 percent of its SWP entitlement and less than 60 percent of its CVP entitlement. As the County continues to grow, additional supplemental supplies will be needed to meet future demand. Based on the DWR studies reflecting the existing regulations and the proposed EPA Delta water quality standards, the County's supplemental water needs after subtracting, conservation and reclamation estimates, will be approximately 130,000 AF/yr at the 2010 demand level during a critical dry period. Figure 1 illustrates the relative magnitude and frequency of the County's supplemental supply requirements. The identified supplemental supply requirement does not include any carriage water or environmental water that may be required for north-to-south water transfers through the Delta. The supplemental supply requirement of 130,000 AF/yr represents over 50 percent of the County's 2010 residential demand.

If the projects are subjected to sustained regulatory and drought shortages of the magnitude and frequency that have been identified by DWR and the SCVWD, water transfers will be one of the essential measures to meet Santa Clara County's future needs. A definitive analysis has yet to be completed that determines the feasibility of the north-to-south transfers to meet supply shortages. Considerations that will effect the transfer alternative are storage requirements south of the Delta to store transfer water, ESA pumping restrictions, export limits, the availability of water during critically dry years, and additional environmental water that may be required to move transfers through the Delta. Until the feasibility of using transfers to meet long-term supply shortages due to regulatory constraints can be established, the viability of the transfer alternative will remain questionable. The regulatory agencies governing the export of water from the Delta need to insure water transfers to mitigate for the water supply impacts of the existing and proposed Delta regulations.

ECONOMIC IMPACTS OF WATER SHORTAGES

Replacing the water supplies discussed above will result in additional costs to Santa Clara County over those already identified to meet needs that will occur under D-1485. The additional impact of the new regulations will raise the total supplemental water needs to 30 percent of the county's total water needs in 2010.

Analytical Basis

The economic impacts of the water supply shortages are estimated as the costs to acquire new supplies and the welfare costs of any shortages that are expected to occur. A range of costs is estimated for the two urban scenarios outlined in the "Proposed Revised Analytic Framework..." prepared by EPA and dated 7/11/94. The "transfer" scenario assumes all decreases in project deliveries can be filled through water transfers. Costs under the second, or "drought shortage," scenario are estimated using welfare values associated with the percent reduction in the residential sector demand that is necessary under the available supplies.

The welfare costs of the projected water shortages are based on an economic concept known as consumer surplus and reflect the costs imposed on water users through drought water pricing, purchases of water-conserving equipment, and changes in consumer behavior that result in a lower quality of life. The welfare loss values used are based on a study of consumer responses to water shortages in Los Angeles.

In practice, these scenarios are not feasible approaches to water supply planning for SCVWD. The availability of transfers in critical years is highly unknown and would probably not meet reliability goals. Similarly, the high percentage of shortages that could occur under the "drought shortage" scenario may not be acceptable to customers and supply planners alike.

Costs were estimated for the SCVWD's supplemental water requirements under the two regulatory actions following the SWRCB's D-1485: the existing NMFS regulations for the winter-run salmon under the ESA, and the proposed EPA water quality regulations. The EPA regulations are thus the second tier of supply reductions and would require consideration of supply and demand management options that are even more costly per unit than those necessary to offset losses anticipated from the ESA delivery reductions.

Considering both the SCVWD estimated imported water deliveries (SWP, CVP, Hetch Hetchy) to Santa Clara County based on the proposed EPA standards and the local water supply, storage, and distribution system, current water supplies are adequate at the 1995 level of demand in the County. However, an additional 28,000 AF/yr would be required through a critical dry period over and above the NMFS delivery impacts at the 2010 level of demand in the County. The incremental costs to acquire 28,000 AF due to proposed EPA regulations are in addition to the costs needed to augment supplies by over 100,000 AF/yr under the supply and economic impacts associated with D-1485 and the winter-run salmon regulations.

The baseline conditions for each time frame include supply and demand management activities already planned in Santa Clara County. As discussed above, these include reclamation and water conservation measures. The SCVWD has discussed possible water transfers agreements with potential suppliers, but currently has no contract for water purchases beyond those from the SWP and CVP.

Water Supply and Welfare Costs

SCVWD has assumed all supply shortfalls result in cutbacks to the residential sector although the allocation of shortfalls would be implemented by the County's water retailers, not SCVWD. Demand projections for Santa Clara County show residential demand to be roughly 53% of countywide demand or 192,000 AF/yr in 1995 and 240,000 AF/yr in 2010.

The cost of water transfers is assumed to be $355 per AF, based upon the current avoided costs of alternative water supplies to SCVWD. Welfare costs were keyed to the differing percentage reductions projected to occur over the range of hydrological conditions. The welfare loss values used are:

Percent Reduction	Cost ($/AF)
1% to 10%	1,400
11% to 20%	1,700
20% and above	2,000

Losses above 20% were valued at $2,000 per AF under the assumption that mandatory reductions above 20% would not be allowed to occur without investments alternative costing up to a maximum of $2,000 per AF.

Costs of Water Supply Impacts

The reductions in Delta water supplies estimated by DWR for the EPA do not impose additional requirements on the District in 1995. However, by 2010 the incremental shortages from the EPA standards would have an adverse impact on the District's ability to supply residential needs. Based on imported shortages arising from the incremental delivery reductions of the EPA's proposed standards, County shortages would exceed 25,000 AF (10% of residential demand) one year in three.

The proposed EPA regulations would result in the following incremental costs over the impacts of the winter-run salmon regulations for the 2010 level of demand:

	Cost of Transfers	Welfare Losses
7 yr Critical Dry Period	$ 10,000,000/yr	$ 56,000,000/yr
71 yr Long-term Average	$ 4,000,000/yr	$ 25,000,000/yr

To meet demands in 2010, the incremental cost under the transfer scenario is estimated to average $4 million annually, assuming that transfers are readily available. The maximum annual incremental cost in a critical dry period would be $10 million to purchase 28,000 AF. Under the shortage scenario, welfare losses in the residential section of Santa Clara County are estimated at $56,000,000 in each critical dry year. Over the 71 years of historical hydrology, welfare losses of this magnitude would be expected to occur one year in three on average, and sequences of 3 or more consecutive dry years are likely. The methodology for estimating welfare losses does not account for the cumulative impacts of consecutive dry years. If the County's water supply is perceived as unreliable, the economic impact would expand to the industrial and commercial sectors, and anticipated job growth will not occur, curbing the economic vitality of Silicon Valley.

Understanding the magnitude and frequency of economic impacts that would occur in critical dry years is essential for SCVWD's water supply and financial planning because the County must plan to mitigate potential critical year impacts in the near term. The capital and operating funds that would be required to replace lost supplies represent significant additions to current SCVWD budgets.

In a critical dry period, the $10 million cost of transfers to replace the incremental EPA impact of 28,000 Af is 16% of the District's current operation budget.

This would be in addition to the $36 million needed to replace the 102,000 AF that are needed under the current regulations: D-1485 and the NMFS winter-run salmon regulations. The cost would total $46 million or 74% of the current operating budget to acquire 130,000 AF of transfer water.

While the impacts are lower than estimated for the standards proposed in December 1993, the forgoing demonstrates that the revised standards being evaluated by EPA would result in significant water shortages and costs in Santa Clara County. The District's analysis supports arguments for a comprehensive solution that addresses all factors contributing to water quality degradation in the Bay-Delta estuary.

TABLE A: 1995 Estimated Santa Clara County Water Supply
(Thousand Acre Feet/yr)

Hydrologic Basis	Local Surface	Local GW	SWP D1485 + nmfs	CVP D1485 + nmfs	Hetch Hetchy	TOTAL
LTA	91	112	95	98	72	468
CDP	54	74	79	75	67	349

LTA = Long Term Average, CDP = Critical Dry Period

TABLE B: Estimated Santa Clara County Water Needs
(Thousand Acre Feet/yr)

Year	Demand	BMP's	Reclaimed	Needs
1987	393	0	2	391
1990	320	0	2	318
1995	375	12	2	361
2010	488	42	17	429

TABLE C: Estimated SCVWD SWP and CVP Deliveries
"Long Term" Average Under D1485/NMFS/EPA Standards
(Thousand Acre Feet/yr)

Demand Level	SCVWD Entitlement	D1485 Delivery	NMFS Delivery	EPA + NMFS Delivery
1995 @ 6.0	252.5	199	193	179
2010 @ 7.6	252.5	166	160	147

Project demands: 1995 = 6.0 MAF/yr, 2010 = 7.6 MAF/yr

TABLE D: Estimated SCVWD SWP and CVP Deliveries
"Critical Dry Period" Under D1485/NMFS/EPA Standards
(Thousand Acre Feet/yr)

Demand Level	SCVWD Entitlement	D1485 Delivery	NMFS Delivery	EPA + NMFS Delivery
1995 @ 6.0	252.5	178	154	123
2010 @7.6	252.5	145	125	98

Project demands: 1995 = 6.0 MAF/yr, 2010 = 7.6 MAF/yr

TABLE E: County Total Imported Supply Reductions Due to EPA Proposed Standards relative to D1485 + NMFS (Thousand Acre Feet/yr)

	1995		2010	
	LTA	CDP	LTA	CDP
SWP + CVP	14	31	46	54
Hetch Hetchy	1	6	16	27
TOTAL	15	37	62	81

Project demands: 1995 = 6.0 MAF/yr, 2010 = 7.6 MAF/yr

TABLE F: 1995 SCVWD Water Year Type Average Incremental Supply Reductions Due to EPA standards relative to D1485 + NMFS (Acre Feet/yr)

WY TYPE	WET	ABOVE	BELOW	DRY	CRITICAL
SWP	0	2,100	500	3,300	6,400
CVP	2,850	13,100	13,600	21,100	19,600
TOTAL	2,850	15,200	14,100	24,400	26,000

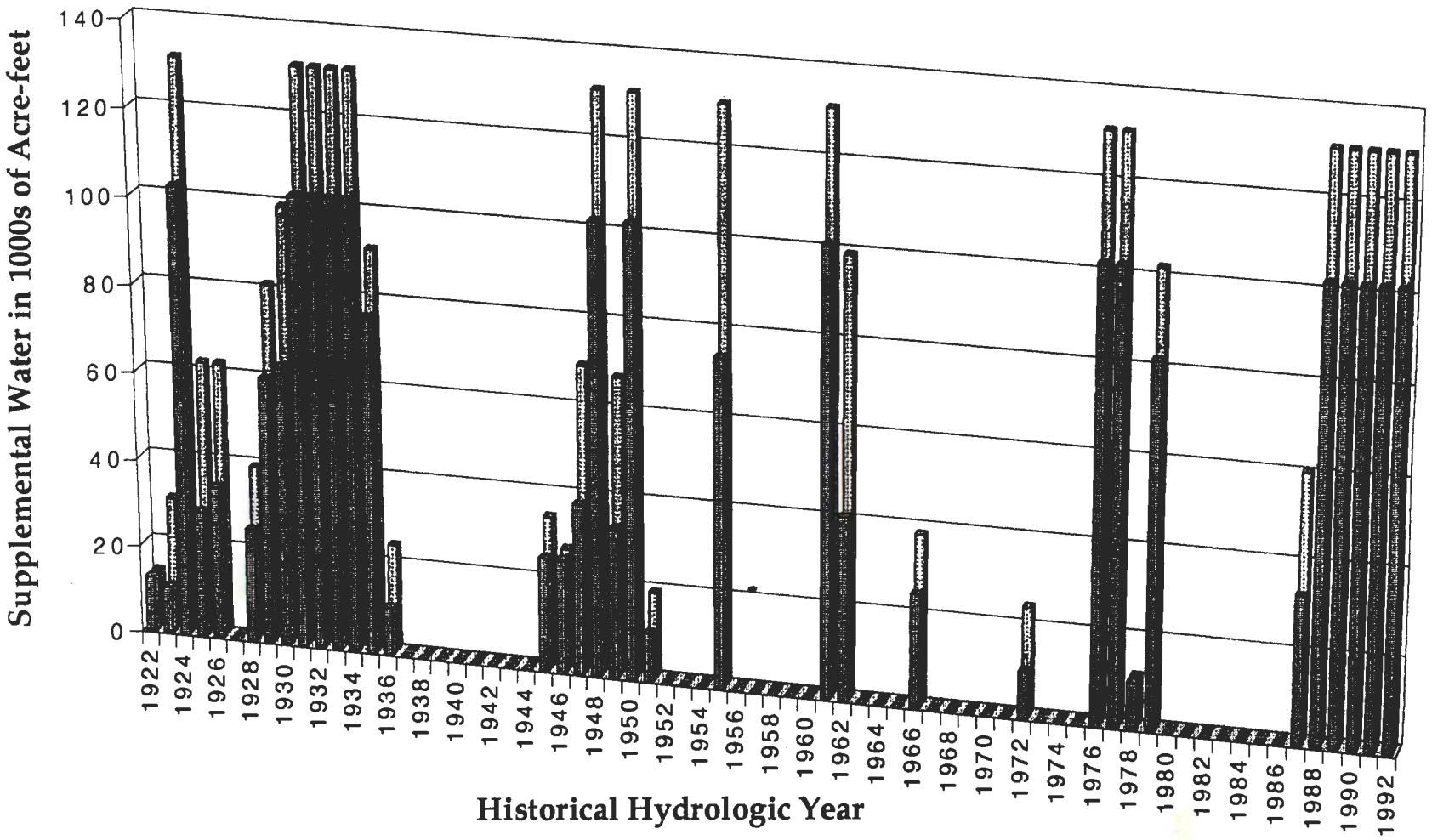
Water Year Type Based on 4-River SRI, Export Demand Level of 6.0 MAF/yr

TABLE G: 2010 SCVWD Water Year Type Average Incremental Supply Reductions Due to EPA standards relative to D1485 + NMFS (Acre Feet/yr)

WY TYPE	WET	ABOVE	BELOW	DRY	CRITICAL
SWP	24,800	30,800	25,100	27,400	31,100
CVP	11,400	20,700	21,200	27,500	23,900
TOTAL	36,200	51,500	46,300	54,900	55,000

Water Year Type Based on 4-River SRI, Export Demand Level of 7.6 MAF/yr

Santa Clara County 2010 Estimated Supplemental Supply Requirements *



* Simulations do not include CVPIA or "take limits"

* System includes storage (groundwater) withdrawal, reclamation, and conservation